

**REMARKS**

Applicant appreciates the Examiner's thorough consideration provided the present application. Claims 1-7 and 9-21 are now present in this application. Claim 1 is independent. Reconsideration of this application is respectfully requested.

**Claim Rejections Under 35 U.S.C. § 103**

Claims 1-7, 13 and 20-21 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Dao, U.S. Patent No. 5,581,034 in view of Lin, "Liquid-Vapor Phase Transition and Bubble Formation in Micro Structure". Claims 1-7, 9, 11 and 13-21 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Leung, U.S. Patent No. 6,182,509, in view of Lin. Claims 10 and 12 stand rejected under 35 U.S.C. 103(a) as being unpatentable over either Dao or Leung, and further in view of Gaitan, U.S. Patent No. 6,171,880. These rejections are respectfully traversed.

Independent claim 1 recites a combination of limitations including "the heater is heated till a temperature of the heater reaches a vaporization point of the liquid, a thermal bubble surrounded by the liquid is gradually formed around the heater due to phase transition from liquid to gas" and "a size of the bubble is kept substantially constant as the temperature difference is being sensed".

The Examiner stated that the Lin reference suggests that the size of the bubble is kept substantially constant by controlling the temperature and the liquid being used (See pages 52-57). However, Applicant carefully studies pages 52-57 of Lin and cannot find the above-mentioned suggestion provided by Lin. The details will be listed as follows.

On page 52, Abstract, only "bubble movement" is mentioned.

On page 52, Introduction, 1st paragraph, no "bubble" is mentioned.

On page 52, Introduction, 2nd paragraph, "bubble formation" and "controlled bubble size" are mentioned. However, the controlled bubble size does not directly teach that **the size of the bubble is kept substantially constant as the temperature difference is being sensed**. This point will be discussed in detail hereinbelow.

On page 52, Introduction, 3rd paragraph, only "bubble formation" is mentioned.

On page 52, Introduction, 4th paragraph, only "formation of bubble " is mentioned.

On page 53, no "bubble" is mentioned.

On page 54; no "bubble" is mentioned.

On page 55, only "bubble formation" and "before the bubble is formed" are mentioned.

On page 56, the first incomplete paragraph, only "bubble formation" is mentioned.

On page 56, the last complete paragraph, only "bubble nucleation" and "bubble formation" are mentioned.

On page 56, the last incomplete paragraph, the bubble forming currents have been plotted with corresponding maximum temperature, as shown in Fig. 9. It never suggests that the bubble forming currents is controlled to keep the bubble size constant as the temperature difference is being sensed.

On page 57, the first complete paragraph, only the "bubble formation" and the shape of the bubble are mentioned.

On page 57, the second complete paragraph:

"The bubble is still growing but with a very slow speed such that a distinct, unblurred bubble image is observed in the photo even though the exposure period was 5 full second."

"The bubble will condense back to liquid within tens of seconds depending on the initial size of the bubble and the heating condition."

That is, the bubble size is not kept constant. Accordingly, Lin never suggests that the bubble forming currents is controlled to keep the bubble size constant as the temperature difference is being sensed.

In the paragraph bridging page 57 to page 59, only "bubble forming temperatures" and "bubble nucleation" are mentioned.

On page 59, the first complete paragraph, only "bubble formation" and "bubble jet printer" are mentioned.

On page 59, the 2nd complete paragraph, only "bubble formation", "movement of the bubble", "an equal volume bubble", "piston-like bubble movement", "bubble-liquid interfacial shear" are mentioned. It is to be noted that the "The surface energy associated with an equal volume bubble is less in the larger dimension locations than in the confined region near the heater" does not teach that **the size of the bubble is kept substantially constant as the temperature difference is being sensed**.

On page 59, the 3rd complete paragraph, only "bubble formation and movement" is mentioned.

In summary, Lin never suggests "**the size of the bubble is kept substantially constant as the temperature difference is being sensed**" as recited in claim 1.

The Examiner stated that the Lin reference suggests that "the bubble sizes are controllable" and "once the bubble is formed within a confined area, the growing of a bubble is much more difficult since the bubble occupies a greater portion of the area near the heater." However, "the bubble sizes are controllable" does not clearly suggest that "the bubble size is kept constant" and never suggest or motivate that **"the size of the bubble is kept substantially constant as the temperature difference is being sensed"**. This is because Lin never suggests when the temperature difference is being sensed and when the bubble size is kept constant. Furthermore, the claimed invention clearly defines that the bubble is formed in a **closed environment** because the cap is arranged above the substrate to cover and encapsulate the heater and the at least two temperature sensing members, and the liquid is filled into a chamber formed between the cap and the substrate. Lin's previous work [8], which presented bubble formation on a micro line heater in an open environment (not a closed environment as that in the claimed invention), states that the controllable bubble sizes. Lin also states "bubble formation in micro channels has several different features than bubble formation in an open environment. So, Lin has provided the teaching to disable the combination of the bubble formations in the closed and open environments. That is, Lin **teaches** the bubble formation in the closed environment **away from** the bubble formation in the open environment. Accordingly, there is no motivation for a person of ordinary skill in the art at the time of the invention to combine Dao and Lin, and Lin never teaches that **the size of the bubble is kept substantially constant as the temperature difference is being sensed**.

In addition, as mentioned, Lin simply discloses the bubble formation in the micro-channel. The bubble formation has been used in the field of ink-jet printers (see page 6, line 13-

15 of the present application). However, Lin nowhere teaches or suggests applying the bubble formation to sense the temperature difference based on the movement of the bubble. In fact, in the field of ink-jet printers, the bubble is formed and then explodes to eject the ink, not formed to be moved by the gravity effect. It is impermissible hindsight reconstruction of the claimed invention using Applicant's structure as a template and selecting elements from references to fill the page. The references themselves do not provide any teaching whereby Applicant's combination would have been obvious. Something in the prior art as a whole must suggest the desirability, and thus obviousness, of making the combination. Unfortunately, the Office Action does not provide objective factual evidence that anything in the prior art suggests the desirability of making the suggested combination.

With regard to the Examiner's reliance on Leung and Gaitan, these references have only been relied on for their teachings related to some dependent claims. These references also fail to disclose the above combination of elements as set forth in independent claim 1. Accordingly, these references fail to cure the deficiencies of Dao.

Accordingly, none of the references utilized by the Examiner individually or in combination teach or suggest the limitations of independent claim 1 or their dependent claims. Therefore, Applicant respectfully submits that claim 1 and their dependent claims clearly define over the teachings of the references relied on by the Examiner.

Accordingly, reconsideration and withdrawal of the rejections under 35 U.S.C. § 103 are respectfully requested.

**CONCLUSION**

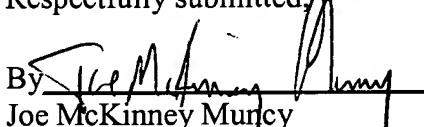
It is believed that a full and complete response has been made to the Office Action, and that as such, the Examiner is respectfully requested to send the application to Issue.

In the event there are any matters remaining in this application, the Examiner is invited to contact Joe McKinney Muncy, Registration No. 32,334 at (703) 205-8000 in the Washington, D.C. area.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§1.16 or 1.17; particularly, extension of time fees.

Dated: March 2, 2006

Respectfully submitted,

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